

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:

Eiichi SUGIHARA, et al.

Serial No.: Unassigned

Group:

Filed: Concurrently

Examiner:

FOR: PROCESS FOR INJECTION FOAMING, AND MACHINE AND COMPOSITION THEREFOR

Date: June 21, 2001

The Hon. Commissioner of
Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Preliminary to examination, please amend the herewith filed application as follows:

IN THE CLAIMS

Please amend claims 1, 2, 8, 9, 10, 13 and 14 as follows, a marked-up copy of the claims showing all changes is attached hereto:

1. (Amended) A process for injection-foaming a thermoplastic resin using an injection molding machine having a two-stage compression screw within a cylinder and to which a physical foaming agent is fed at a midpoint of the cylinder, comprising:

(1) feeding the physical foaming agent into the cylinder from a storage tank at a pressure lower than storage

pressure by a pressure difference between the storage tank and the injection molding machine cylinder;

(2) feeding the foaming agent within a range from the starting point of the second stage of the screw to a length nine times the outside diameter of the screw in the direction of injection at the time the screw is caused to advance most forward in the direction of injection; and

(3) obtaining a foam by reducing the pressure in a cavity of the mold in the injection molding machine to low pressure including practically atmosphere pressure, injecting the resin into the cavity, and then expanding the volume of the cavity.

2. (Amended) The injection foaming process according to Claim 1 wherein the volume of the cavity is expanded by retracting metal plates in the mold after injecting and filling the resin into the cavity.

8. (Amended) The injection molding machine according to Claim 7, wherein the ratio of $L2/L1$, between the depth of the last groove of the first stage of the two-stage compression screw, $L1$, and the depth of the first groove of the second stage of the two-stage compression screw, $L2$, is in the range of 1.2 to 6.

9. (Amended) The injection molding machine according to Claim 8 further comprising a resin check valve installed at the point at which the physical foaming agent is injected into the injection molding machine.

10. (Amended) A resin composition suitable for injection foaming which comprises a thermoplastic resin containing as a foaming nucleator 0.1 to 5 wt% of an inorganic filler having an average particle diameter of 0.5 to 10 μ m to the thermoplastic

resin and/or 0.01 to 1 wt%, calculated as undecomposed material, of a chemical foaming agent or its decomposed material.

13. (Amended) The resin composition according to Claim 10 wherein the chemical foaming agent is a mixture of citric acid and sodium hydrogencarbonate at a ratio of 0.1:0.9 to 0.9:0.1 or its decomposed material.

14. (Amended) A resin composition according to Claim 10 wherein the thermoplastic resin is polyolefin.

Please cancel claims 3-6, 15 and 16 in their entirety and without prejudice.

Please enter the following new claims.

--17. (New) The injection foaming process of Claim 1 wherein the ratio $L2/L1$, between the depth of the last groove of the first stage of the two-stage compression screw, $L1$, and the depth of the first groove of the second stage of the two-stage compression screw, $L2$, is in the range of 1.2 to 6.

18. (New) The injection foaming process of Claim 2 wherein the ratio $L2/L1$, between the depth of the last groove of the first stage of the two-stage compression screw, $L1$, and the depth of the first groove of the second stage of the two-stage compression screw, $L2$, is in the range of 1.2 to 6.

19. (New) The injection foaming process of Claim 1 wherein the physical foaming agent is fed to the molding machine at a lower pressure that is not more than 80% of the storage pressure and is in a gas state or in supercritical condition.

20. (New) The injection foaming process of Claim 18 wherein

the physical foaming agent is fed to the molding machine at a lower pressure that is not more than 80% of the storage pressure and is in a gas state or in supercritical condition.

21. (New) The injection foaming process of claim 1 further comprising feeding the physical foaming agent through a resin check valve installed at the point of entry of the physical foaming agent.

22. (New) The injection foaming process of claim 20 further comprising feeding the physical foaming agent through a resin check valve installed at the point of entry of the physical foaming agent.

23. (New) The injection foaming process of Claim 1 wherein the physical foaming agent is carbon dioxide, nitrogen or argon.

24. (New) The injection foaming process of Claim 22 wherein the physical foaming agent is carbon dioxide, nitrogen or argon.

25. (New) The injection foaming process of Claim 1 further comprising feeding a resin into the first stage of the two-stage compression screw, which resin comprises a thermoplastic resin containing as a foaming nucleator 0.1 to 5 wt% of an inorganic filler having an average particle diameter of 0.5 to 10 μ m to the thermoplastic resin and/or 0.01 to 1 wt%, calculated as undecomposed material, of a chemical foaming agent or its decomposed material.

26. (New) The injection foaming process of Claim 25 wherein the inorganic filler is talc, silica, calcium carbonate or barium sulfate.

27. (New) The injection foaming process of Claim 21 wherein

the chemical foaming agent is a mixture of polycarboxylic acid and hydrogen carbonate at a ratio of 0.1:0.9 to 0.9:0.1 or its decomposed material.

28. (New) The injection foaming process of Claim 21 wherein the chemical foaming agent is a mixture of citric acid and sodium hydrogencarbonate at a ratio of 0.1:0.9 to 0.9:0.1 or its decomposed material.

29. (New) The injection foaming process of Claim 26 wherein the thermoplastic resin is a polyolefin.

30. (New) The injection foaming process of Claim 1 wherein the mold cavity has a volume initially set at a value lower than the quantity of resin being injected.

31. (New) The injection foaming process of Claim 25 wherein the mold cavity has a volume initially set at a value lower than the quantity of resin being injected.--

REMARKS

Entry of the foregoing amendments prior to examination of this application is respectfully requested in view of the following comments.

Claims 1, 2, 8, 9, 10, 13 and 14 have been amended. Claims 3-6, 15 and 16 have been cancelled and new claims 17-31 have been added. Accordingly, claims 1, 2, 7-14 and 17-31 are pending herein.

Claims 1, 2, 8, 9, 10, 13 and 14 have been amended to correct obvious informalities and improper multiple dependencies

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Respectfully submitted,

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6

Marked-Up Claims

1. (Amended) A process for injection-foaming a thermoplastic resin [by] using an injection molding machine [with] having a two-stage compression screw within a cylinder and to which a physical foaming agent is fed [from the middle] at a midpoint of the cylinder, [which comprises] comprising:

(1) feeding the physical foaming agent [is fed] into the cylinder from [the] a storage tank at a pressure lower than storage pressure by a pressure difference between the storage tank and the injection molding machine cylinder;

(2) feeding the [aforesaid] foaming agent [is fed] within [the] a range from the starting point of the second stage of the screw to a length nine times the outside diameter of the screw in the direction of injection at the time [of] the screw is caused to advance most forward in the direction of injection; and

(3) obtaining a foam [is obtained] by [making] reducing the pressure in a cavity of the mold in the injection molding machine [at] to low pressure including practically atmosphere pressure, injecting the resin into the cavity, and then expanding the volume of the cavity.

2. (Amended) [An] The injection foaming process according to Claim 1 wherein the volume of the cavity is expanded by retracting [the] metal plates in the mold after injecting and filling the resin into the cavity.

8. (Amended) [An] The injection [foaming process] molding machine according to Claim 7, wherein the ratio of $L2/L1$, between the depth of the last groove of the first stage of the two-stage compression screw [of the aforesaid injection molding machine], $L1$, and the depth of the first groove of the second stage of the [aforesaid] two-stage compression screw, $L2$, is in the range of 1.2 to 6.

9. (Amended) [An] The injection [foaming process] molding machine according to Claim [7 or] 8 [wherein] further comprising a resin check valve [is] installed at the [part] point at which the physical foaming agent is injected into the injection molding machine.

10. (Amended) A resin composition suitable for [the] injection foaming [process defined in any one of Claims 1 to 6] which comprises a thermoplastic resin containing as a foaming nucleator 0.1 to 5 wt% of an inorganic filler having an average particle diameter of 0.5 to 10 μ m to the thermoplastic resin and/or 0.01 to 1 wt%, calculated as undecomposed material, of a chemical foaming agent or its decomposed material.

13. (Amended) [A] The resin composition according to Claim 10 [or 12] wherein the chemical foaming agent is a mixture of citric acid and sodium hydrogencarbonate at a ratio of 0.1:0.9 to 0.9 [to] 0.1 or its decomposed material.

14. (Amended) A resin composition according to [any one of Claims] Claim 10 [to 13] wherein the thermoplastic resin is polyolefin.